b. contacting a master with a preformed surface bearing a pattern capable of imparting a three-dimensional microstructure of precisely shaped and located functional discontinuities including distal surface portions and adjacent depressed surface portions into the exposed surface of the layer of radiation curable composition on said metal foil backing under sufficient contact pressure to impart said pattern into said layer;

c. while the layer of radiation curable composition is in contact with the patterned surface of the master, exposing said curable composition to a sufficient level of thermal radiation through the metal foil backing to cure said composition to provide a cured polymer which adheres to the metal foil backing; and

d. separating the cured polymer layer on the metal foil backing from the surface of the master.

The various terms utilized in Applicants' claims are clearly defined in the specification. These terms are significant in determining the difference between claimed invention and the cited art.

As noted on page 7,

> The term 'precisely shaped and located functional discontinuities' refers to shapes that are made by predeterminably replicating substantially the inverse configuration borne on a master which has been endowed with original, non-random, precise functional shapes which are precisely located relative to each other and this term is intended to exclude shapes that are merely decorative or randomly textured to provide a frictional surface. (See page 7, lines 21-25.)
>
> The term 'precisely shaped interactive functional discontinuities' refers to shapes as defined above which, after formation, are capable of forming cooperative mechanical arrangements with other complementarily shaped objects. (See page 7, lines 26-28.)
>
> The term 'large scale predictable dimensional stability' refers to the ability of a segment of shaped sheet-like substrate to retain substantially its predicted dimensions after being subjected to a heated environment of 150°C or less for 60 minutes or less and then returned to ambient temperature. (See page 7, line 29 to page 8, line 1.)

The claimed method produces a composite article having large scale predictable dimensional stabilitly.

On page 5 of the Office Action the Examiner incorrectly characterizes the term "large scale predictable dimensional stability." The Examiner notes that this definition is "inclusive merely of ambient conditions." This is not correct since, as explained above, an article prepared by the claimed method has dimensional stability which is substantially retained even after the article is heated to 150° or less for one hour or less and returned to ambient conditions. The definition is not "inclusive merely of ambient conditions" as asserted by the Examiner.

The Rejections

Claims 5, 6, 11, 13, 27, 28, 32 and 34 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Delaney, et al. (US 6,358,442 B1).

In making this rejection, the Examiner asserts that Delaney, et al. teach a method of making a composite article comprising depositing a radiation curable composite onto the surface of a backing, contacting a master with a preformed surface under sufficient pressure to impart the pattern into the layer of composition, exposing the layer to sufficient radiation to cure it, and separating the cured polymer layer and the backing from the master. The Examiner notes that Delaney, et al. teach that the backing may be a metal foil and it is the Examiner's position that this backing is radiation transmissive, in the sense explained in Section III of the Office Action. Examiner notes that the preformed surface of the masters pattern is a pattern of fine lines and states that it is the Examiner's position that this pattern of fine lines reads on Applicants' claimed three-dimensional microstructure as described at pages 7-8 of the specification. Further, the Examiner states, with respect to claim 27, it is the Examiner's position that this pattern also reads on the interactive functional discontinuities as defined on page 7 of the specification. The Examiner notes that although Delaney, et al. do not explicitly state that the exposure is through the master, it is clearly illustrated as such in Figs. 1B, 2A and 3.

Delaney, et al. do not impart "precisely shaped and located functional discontinuities" into the surface of their product, as defined in the claims of the present application. The definition given on page 7 of the application indicates that the present method provides shapes which, after

formation, "are capable of forming cooperative mechanical arrangements with other complementarily shaped objects." (See page 7, lines 26-28.)

Specific examples include cavities which are shaped to receive a particular complementary shaped particle or items which are capable of forming cooperative mechanical arrangements with the features of the surface of the polymer layer. This is explained on page 15, lines 12-27. Cavities may be rectangular, circular, semicircular, triangular, square, hexagonal, etc. Cavities may be vertical or tapered and the base portions of the cavities may be hemispherical, conical or flat. One example of such an article is a composite article depicted in Fig. 3 which depicts a gyricon or twisting-ball display, as disclosed in US Patent No. 5,754,332.

Applicants' definition of "precisely shaped and located functional discontinuities . . . is intended to exclude shapes that are merely decorative or randomly textured to provide a frictional surface." (Page 7, lines 24-25.)

Delaney, et al's. articles would not provide shape which is capable of "forming cooperative mechanical arrangements with other complementary shaped objects." (Page 7, lines 27-28.) On the contrary, Delaney, et al. provide improved diffraction-refraction and holographic high-gloss surface papers, boards and the like (Abstract).

Furthermore, Applicants' claim 5 requires "exposing said composition to a sufficient level of radiation through the master to cure the composition." (Claim 5, subparagraph c.)

In Delaney, et al's. Figs. 1B and 2A, the master is identified by I. The exposure is through the radiation-curable adhesive composition A, not through the master.

By contrast, Delaney, et al's. embossed pattern is "provided with an embossed predetermined diffraction pattern formed of fine lines." (Col. 2, lines 43-44.) Delaney, et al's. pattern is said to have "of the order of about 25,000 [lines] per inch." (Col. 3, line 33.) Thus, Delaney, et al's. process fails to produce the type of article that Applicants' process produces.

The Examiner asserts that Delaney, et al. teach that the backing may be a metal foil, but Delaney, et al's. metal foil is not the same as Applicants' definition of the term metal foil, as noted in the paragraphs bridging columns 4 and 5 of Delaney, et al. Delaney states:

> Turning to the added use of metallization, with its more vibrant shiny effects, there are three alternative procedures that can be used with the techniques of the invention.
>
> First, the embossed film master 1[sic] of FIG. 1A may be metallized, as before described, by using a vacuum deposition chamber, that deposits a very thin layer of metal, following the pattern of the embossed diffraction pattern lines L of the film master I, as shown in FIG. 2A at M, and reproducing the diffraction pattern L2 on the inner surface of the metal deposit M adjacent the film line pattern L. The outer surface of the metal layer may then be coated with the radiation-curable adhesive A of the invention, pressed against the paper or other substrate P and cured, with the resulting stripped off product P-M, FIG. 2B, having the extraordinary shiny prism-like and/or holographic effects.

By contrast, Applicants' metal foil is comprised entirely of metal. (See page 7, first paragraph and page 8, line 4, where the term "metal foil" is defined as being "a thin continuous sheet of metal." Also see page 10, lines 3-9 for further explanation of the metal foil:

> The metal foil preferably has a thickness of at least about 10 micrometers to provide sufficient strength and preferably does not exceed about 50 micrometers so that it permits the passage of sufficient radiation to permit curing of layer 14 and so that it is not undesirably stiff for future applications. It should be noted, however, that some applications may require a stiffer backing and in such cases, thicknesses in excess of 50 micrometers may be suitable if the backing will permit passage of sufficient radiation to facilitate curing.

Thus, Delaney, et al. fail to teach the present invention because they produce a sheet with a holographic image not with precisely shaped and located functional discontinuities. Applicants' terms specifically exclude shapes that are merely decorative.

Claims 5, 6, 11, 13, 27, 28, 32 and 34 stand rejected under 35 U.S.C. § 102(b) as anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over Kerr, et al. (WO 90/15673). In making this rejection, the Examiner indicates that Kerr, et al. teach a method of making a composite article comprising depositing a radiation curable composition onto the surface of a backing, contacting a master with a preformed surface under sufficient pressure to impart a pattern to the layer of the composition, exposing the layer to sufficient radiation to cure

it, and separating the cured polymer layer and the backing from the master. It is the Examiner's position that the pattern of cavities and depressions on the impressor belt, imparted to the coating, reads on Applicants' claimed three-dimensional microstructure as described at pages 7 and 8 of the specification. This is not correct. Applicants' definition of three-dimensional microstructure of precisely shaped and located functional discontinuities "is intended to exclude shapes that are merely decorative or randomly textured to provide a frictional surface." (Page 7, lines 24-25.) Kerr, et al. make no mention of imparting the type of surface structure that Applicants' method provides. On the contrary, Kerr, et al. state as follows:

> These films can be embossed with a wide variety of surface textures, using a heated metal roller. Polyester and polyolefin films having leather and fabric textures, mat surfaces, smooth glossy surfaces, and many others are presently commercially available. Non-polymeric materials such as thin-gauged metal can also be used. As used herein, the term 'texture' includes surfaces ranging from glossy to formed. (Paragraph bridging pages 4 and 5.)

Also, Kerr, et al. state:

> preferred substrates include thermoplastic sheets, films. Decorative and protective coatings for these materials greatly increase the scope of their application. (Paragraph bridging pages 5 and 6.)

Kerr, et al. fail to mention any type of surface discontinuities that are produced by the presently claimed method.

The rejection of claim 7 under 35 U.S.C. § 103(a) as being unpatentable over Delaney, et al. (US 6,358,442 B1) is unwarranted and it should be withdrawn. Claim 7 further defines the method of claim 5 to indicate that, after contact, the polymer layer will include a distal surface portion distally spaced at least 0.05 mm from an adjacent depressed surface. The Office Action states that this reference does not teach that, after contact with the master, at least one portion of the polymer layer will include a distal surface portion distally spaced at least 0.05 mm from an adjacent depressed surface portion. The Office Action indicates that the teaching of Delaney, et al. is quite clear that, while some particular dimensions of the pattern may be disclosed, the

invention is not limited to these dimensions, and pictures of the pattern are at the discretion of the artisan to achieve the desired result, citing column 3, lines 20-55. However, all of the disclosure in the cited text pertains not to the type of functional discontinuities produced by Applicants' method, but instead to patterns having image "holographic image effects" or "refraction-diffraction fine lines or rulings." No mention is made of the type of functional discontinuities defined in the present invention. Furthermore, claim 7 defines the dimension between the top of a peak and the bottom of an adjacent trough is by the embossing of claim 5. Delaney, et al's. dimensions refer to the frequency of lines formed by embossing on the backing.

The rejection of claim 7 under U.S.C. 103(a) is unwarranted and it should be withdrawn.

Claims 8 and 29 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Delaney, et al. ('442) as applied to claims 5 and 27, respectively, and in further view of Schädlich, et al. ('247).

The Office Action indicates that the teaching of Delaney, et al. is as set forth in rejection section 1. The Office Action further indicates that Delaney, et al. do not teach the foil backing is selected from the group consisting of Cu, Al, Zn, Ti, Sn, Fe, Ni, Au, Ag, combinations and alloys thereof. Claim 8 further defines the invention of claim 5 to specify the particular group of metals which would comprise the metal foil. The Office Action indicates that Schädlich, et al. teach, in the art of making holographic articles, it is well-known to utilize an aluminum foil backing. Schädlich, et al. teach a process for selectively deforming a thermoplastic layer method of making dimensionally stable composite article to provide "relief images" in the thermoplastic layer. (Col. 1, line 45.) No mention is made of utilizing the process to make any type of precisely shaped interactive functional discontinuities in Schädlich, et al.'s embossed thermoplastic layer as provided by the method of the present invention. Applicants' definition of interactive functional discontinuities specifically excludes decorative or imagewise patterns in an embossed surface. While Schädlich, et al.'s process may include an aluminum foil electroconductive supporting material (Col. 1, lines 20-23) there is no indication that their master would impart the type of cavities in the embossed film that are defined in the method of the present invention. Furthermore, Schädlich, et al.'s aluminum layer is provided by a polyester film carrying a vacuum-deposited aluminum layer which they regard as an aluminum foil. (See

Example 3, Col. 9, lines 25-30.) Thus, Schädlich, et al.'s fail to disclose utilization of a metal foil as defined in the present method.

Claims 1-4, 8, 9, 24-26 and 30 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Delaney, et al. ('442) in view of Schädlich, et al. ('247), Wood ('927) and Kerfeld ('077). In making this rejection, the Examiner indicates that the teaching of Delaney, et al. is described in the rejection noted in section 1. The Examiner further states that Delaney, et al. teach a method of making holographic composite articles. The Examiner admits that Delaney, et al. do not teach with respect to claim 1 and claim 24 that the radiation curable composition is cured by a radiation through the metal foil backing. The Office Action goes on to say that Schädlich, et al. teach in the art of making composite holographic articles, is well known to utilize aluminum foil backing. However, as explained above, Schädlich, et al.'s aluminum foil backing is not a metal foil as defined in the specification of the present application. Instead it is a polyester film carrying a vacuum-deposited aluminum layer. (See Example 3, Col. 9, lines 25-31.)

Claims 1-4, 8, 9, 24-26 and 30 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Delaney, et al. ('442) in view of Schädlich, et al. ('247), Wood ('927) and Kerfeld ('077). In making this rejection, the Examiner states that the teaching of Delaney, et al. is described in rejection section 1 of the Office Action and that Delaney, et al. teach making holographic composite articles. However, the present method is not a method of making holographic composite articles, it is a method of making articles that have a surface which includes precisely shaped and located functional discontinuities that are capable of forming cooperative mechanical arrangements with other complementarily shaped objects.

The Examiner admits that Delaney, et al. do not teach: with respect to claims 1 and 24, that the radiation curable composition is cured by irradiating through the metal foil backing. The Examiner attempts to cure this deficiency by citing Schädlich, et al. which teaches the art of making composite holographic articles by utilizing a metal foil backing. As previously mentioned, the present method is not involved in making holographic articles, but instead articles having precisely shaped and located functional discontinuities which specifically excludes shapes that are merely decorative or randomly textured. Furthermore, Schädlich, et al. does not utilize a metal foil as defined in the present application. Schädlich, et al.'s foil is a polester film which is

vapor coated with a coating of aluminum, whereas the present application utilizes metal foils that are comprised completely of metal. The Examiner indicates that Wood is cited merely to show that electron beams will penetrate aluminum foil to cure a coated resin thereon. While Wood does disclose "metal aluminum foil" (Col. 3, line 58), no suggestion is made in Wood of making the type of articles by the process defined in the claims of the present application. The mere fact that Wood shows that one can erradiate a beam through a metal aluminum foil is of no moment since none of the references cited by the Examiner disclose any method of making the types of articles defined in the method claim of the present application since none of them utilize a master with a preform surface bearing of pattern capable of imparting a three-dimensional microstructure of precisely shaped and located functional discontinuities. In any event, there is no incentive for one skilled in the art to make the combination of four references which the Examiner relies upon for this rejection. The Examiner is utilizing inappropriate hindsight reasoning to find bits and pieces of the claimed method while ignoring other teachings of the references themselves.

The Examiner relies on Kerfield for a teaching in the art of curing a radiation curable composition coated on a substrate in contact with a master, when the backing is transmissive and the curing radiation effected by irradiating through the backing. The Examiner ignores, however, the fact that present method claims define a method of making a particular type of article whereas Kerfeld describes a method of making video disks rather than the type of article defined in the claims of the present application. Furthermore, there is no incentive for one skilled in the art to combine Delaney, et al., Schädlich, et al., Wood and Kerfeld to arrive at the combination of teachings that the Examiner has asserted. The Examiner is utilizing hindsight reasoning in making the combination by looking for bits and pieces of Applicants' claimed invention in the various pieces of art while ignoring the main teaching of these references.

Claim 7 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Kerr, et al. (WO 90/15673). As previously mentioned, Kerr, et al. do not teach the method of claim 7. Claim 7 defines a polymer layer as having a distal surface which is distally spaced at least about 0.05 mm from an adjacent depressed surface portion. The rejection which is presumed to be based on the combination of Delaney, et al. and Kerr, et al. is unwarranted and it should be

withdrawn. There is no description in Kerr, et al. of the method defined in claim 7 of Applicants' application.

The Examiner has noted that claims 10, 12, 31 and 33 are objected to as being dependent upon a rejected base claim. The Examiner has indicated that these claims would be allowable if rewritten in independent form, including all of the limitations of the base claim and any intervening claims. New claim 51 is submitted in the Amendment. New claim 51 is a method claim and, thus, falls within the elected group of claims. New claim 51 is thought to be allowable because it defines the radiation as being "thermal radiation." (See 51(c).) An indication of allowance of new claim 51 is, therefore, respectfully requested.

It is submitted that the elected claims 1-13 and 24-34 are also allowable in view of the comments set forth above. Reconsideration of the rejection is, therefore, respectfully requested.

Respectfully submitted,

3/31/03
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Version with markings to show amendments made:

METHOD OF MAKING DIMENSIONALLY STABLE COMPOSITE ARTICLE[AND METHOD OF MAKING THE SAME]

A further utility of the composite article of the present invention is depicted in Fig. 3. Fig. 3 depicts a gyricon or twisting-ball display, as disclosed in US Patent No. 5,754,332 [(Joseph,](Crowley), incorporated herein by reference. The display includes bichromal balls 63 which are each deployed in a cavity or well 66 formed in a polymer substrate 68

Example 6

A master pattern was prepared by laser ablation in a 75 µm thick polyimide film available under the trade designation KAPTON polyimide film from DuPont in Wilmington, DE. The pattern consisted of rows of oval wells arranged offset by half pitch in the length direction. This pattern is useful for receiving conductive spheroids for later incorporation into z-axis conductive adhesives, as disclosed in[WO 200000563A,] WO 00/00563, incorporated herein by reference. This master was replicated into nickel by

51. (New) A method of making a composite article having large scale predictable dimensional stability, said method comprising:
    a. depositing a layer of a radiation curable composition onto one surface of a radiation transmissive metal foil backing to provide a layer having an exposed surface;
    b. contacting a master with a preformed surface bearing a pattern capable of imparting a three-dimensional microstructure of precisely shaped and located functional discontinuities including distal surface portions and adjacent depressed

surface portions into the exposed surface of the layer of radiation curable composition on said metal foil backing under sufficient contact pressure to impart said pattern into said layer;

c. while the layer of radiation curable composition is in contact with the patterned surface of the master, exposing said curable composition to a sufficient level of thermal radiation through the metal foil backing to cure said composition to provide a cured polymer which adheres to the metal foil backing; and

d. separating the cured polymer layer on the metal foil backing from the surface of the master.